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VIA ELECTRONIC FILING

September 18, 2018

Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 201154

Re: ***Ex Parte* Letter, GN Docket No. 17-183**, *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*

Dear Ms. Dortch:

Wi-Fi Alliance continues to be encouraged by recent statements from the Commission and Congress as to the importance of the use of the 5925-7125 MHz (the "6 GHz Band") for unlicensed operations, including Wi-Fi -- Commissioners O'Rielly and Rosenworcel, along with Representatives Matsui and Guthrie, recently published an op-ed urging action on the band,[1/] and Chairman Pai has indicated that the Commission will consider a Notice of Proposed Rulemaking ("NPRM") this fall.[2/] The record in the above-referenced proceeding presents overwhelming evidence that the current spectrum on which Wi-Fi – through which the majority of Americans reach the Internet – operates is simply insufficient to meet expanding needs and technology developments.[3/]

1/ Reps. Doris Matsui and Brett Guthrie and Jessica Rosenworcel and Mike O'Rielly, *The Next Generation of Wireless Innovation*, THE HILL, Sept. 12, 2018.

2/ *See* Letter from Ajit Pai, Chairman, Federal Communications Commission to John Thune, Chairman, Senate Committee on Commerce, Science, and Transportation, August 10, 2018 ("That's why I have announced that the Commission will be moving forward with a rulemaking to consider opening up the 6 GHz band to unlicensed use this fall.") *See also* Ajit Pai, Chairman, Federal Communications Commission, *Scoring a Victory for 5G*, FCC Blog Post, Jun. 20, 2018, available at https://www.fcc.gov/news-events/blog/2018/06/20/scoring-victory-5g.

3/ *See e.g. Comments of All Points Broadband, Amplex, Apple, Blaze, Broadcom, Cambium, Cisco, Cypress, Dell, Extreme, Facebook, Fire2Wire, Google, Hewlett-Packard, Intel, Joink, MediaTek, MediaLINK, Microsoft, NewWave, Pixius, QUALCOMM, Rise, Ruckus, Snappy, Sony, Western, WISP Association, Wisper*, GN Docket No. 17-183 at 5 (filed Oct. 2, 2017) (noting that Wi-Fi is facing serious crowding); *Comments of Broadcom Ltd.*, GN Docket No. 17-183 at 25 (filed Oct. 2, 2017) (noting that additional mid-band spectrum is "critical to addressing the unlicensed spectrum crunch"); *Comments of Hewlett-Packard Enterprise Company*, GN Docket No. 17-183 at 2 (filed Oct. 2, 2017) (noting that Wi-Fi "will soon run out of spectrum."); and *Comments of the Wireless Broadband Alliance*, GN Docket No. 17-183 at 7 (filed Oct. 2, 2017) (discussing a "profound and growing need for additional designations of mid-band spectrum for unlicensed operations).

Wi-Fi Alliance recognizes that in order to meet growing connectivity demands, Wi-Fi must have access to additional spectrum while existing users in the 6 GHz Band must be protected from harmful interference. The technical studies on the record confirm that the risk of interference to the existing operations in 6 GHz is low.[4/] In the case of fixed service links, in particular, even using conservative assumptions, the probability of Wi-Fi-caused interference leading to a 1 dB or more of reduction in fade margin is less than 0.2%.[5/] In this regard, it is worth noting that a 1 dB reduction in fade margin for fixed microwave links is not necessarily harmful. In fact, the RKF study concluded that this was not harmful because it did not have an impact on link availability.

In order to mitigate those limited cases of interference, Wi-Fi Alliance has proposed a comprehensive regulatory solution comprised of limits on transmit power, limits on antenna gain and pointing restrictions, a geo-location requirement based an automatic frequency coordination ("AFC") mechanism and other techniques. In the case of indoor-only class devices, a concept already established in the FCC rules,[6/] Wi-Fi Alliance proposed that regulatory restrictions on conducted power at 250 milliwatts and antenna gain of no more than 6 dBi, will be sufficient to protect incumbent operations in the 6 GHz Band. As noted above, RKF found that the likelihood of interference to incumbent operations from RLAN operations in the 6 GHz band was less than 0.2%. That assessment covered *all* potential use cases, including all outdoor and regular power indoor operations. With a significant portion of RLANs operating under AFC, and the remainder operating at significantly reduced power, the probability of interference from low-power, indoor RLANs ("LPIs") transmitters is much lower than 0.2%.

Recently, CommScope, Inc. ("CommScope") submitted an *ex parte* notice suggesting that "[a]ll RLANS must use coordination system", including the indoor-only, low-power devices.[7/] CommScope asserts that LPIs could cause line-of-sight interference when operating in buildings within the boresight of microwave receiver.[8/] CommScope focused on one particular fixed microwave link, a connection between Liberty Plaza in Manhattan and a New York fire department station antenna in Queens.[9/] CommScope's concerns are unfounded. Even in this carefully selected, unique edge case, there is *de minimis* risk of harmful interference from LPIs.

4/ *See* Letter from Paul Margie, Counsel to Apple Inc., Broadcom Corporation, Facebook, Inc., Hewlett Packard Enterprise, and Microsoft Corporation, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183, Jan 25, 2018 (attaching a study by RKF Engineering showing the coexistence between unlicensed networks and incumbent operations in the 6 GHz band) ("RKF Study").

5/ *Id.* at 53 (5.2.6): ("The study found that across all runs, approximately 99.8% of the FS stations within CONUS had aggregate interference levels from RLAN operations below -6 dB I/N")

6/ *See*, 47 C.F.R. §15.407 (a)(ii). *See also Reply Comments of Wi-Fi Alliance*, GN Docket No. 17-183 at 14 (filed Nov. 15, 2017) ("WFA Reply Comments").

7/ *CommScope Letter* at Attachment A, page 6.

8/ *CommScope Letter* at Attachment A, pages 11-14.

9/ *Id*.

Indoor Operations Present Little Risk of Interference

The nature of indoor operations, especially residential and general commercial installations, means they pose a minimal interference risk. *First*, signal attenuation resulting from clutter loss from objects, such as furniture, and the walls and windows of the structure will result in very little of the LPI's emissions reaching the outdoors.[10/] *Second*, most residential and general commercial installations will be placed near ground level, where they would pose reduced risk to fixed wireless deployments, which are, generally, more than 40 meters above ground level. [11/] This will make true 'line of sight' deployments, the primary source of interference risk,[12/] improbable. *Third*, building attenuation for the LPI's emissions from devices operating more than 40 meters above ground level, typically, is significantly higher than average.

As Wi-Fi Alliance has noted, these consumer-grade devices would generate signals substantially below the -6 dB I/N interference criteria utilized in the RKF report[13/] and accepted by incumbent licensees as the threshold for harmful interference.[14/] Because of their reduced interference risk, a site-coordination requirement (*e.g.*, AFC) is unnecessary for lower-power access points operating indoors.

CommScope Overstates the Interference Potential from LPIs

CommScope asserts that, for the specific case in its analysis, the interference level would exceed the -6 dB I/N interference criteria by more than 8.1 dB. But CommScope's assumptions are unrealistic because it assumes only a 20 dB building entry loss. That assumption is overly conservative for the analysis of the specific link in the CommScope's analysis, and for similar links with high-rise buildings in their boresights. The 20 dB figure is in fact an average estimate covering a wide variety of building construction types, ranging from simple wood, drywall, and siding, to heavy, steel-reinforced concrete. Even different types of windows can impact building entry loss, with double-pane, insulated, high-efficiency glass which cannot be opened absorbing far more of a signal's energy than residential windows. Of course, these different materials in

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10/ *WFA Reply Comments* at 15, citing Recommendation ITU-R P.452-16 Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz.

11/ *See* Letter from Alex Roytblat, Senior Director of Regulatory Affairs to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 (August 8, 2018) at Appendix, citing to ULS data.

12/ *See* Letter from Cheng-yi Liu and Mitchel Lazarus, Counsel for the Fixed Wireless Communications Coalition, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183 at 11, Mar. 13, 2018 (noting that interference "from obstructed signals is nearly always insignificant. Actual interference comes from the comparatively infrequent case of an emitter that happens to line up with a microwave receiver over an unobstructed path").

13/ *RKF Report* at 5-6, 11.

14/ *See,* Letter from Cheng-yi Liu, Counsel for the Fixed Wireless Communications Coalition to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183, Jul. 17, 2018 at Attachment p. 14.

fact have dramatically different signal attenuation properties, with the denser materials resulting in less signal-energy reaching the outdoors.

A 30 dB building entry loss figure is more realistic for the high-rise buildings at issue with this link. The structures in which LPI devices would be located in Manhattan are generally constructed of steel-frames and encased in concrete or high-efficiency, shaded glass windows designed to seal the building off from the exterior. These buildings, therefore, are unlike most residential or commercial structures, and should not be analyzed using "average" emissions attenuation figures. The attached Exhibit A shows a more accurate assessment of the potential for interference – from the building that was the subject of the CommScope analysis.

In general, taller structures that are more likely to reach the boresight of a fixed microwave link are also more likely to be constructed of the dense, energy-efficient materials which will attenuate more of indoor generated signals and, thereby, reduce interference risk. In other words, as the protection granted by the second factor discussed above (the height of the LPI) is reduced, the protection granted by the third factor (signal attenuation by the building's structure and materials) is increased, resulting in little to no net increase in harmful interference risk even when deployments are line-of-sight.

Excess Fade Margin Provides Ample Additional Protection for Shorter Links

As noted in this proceeding, the propagation characteristics of the 6 GHz Band make it particularly appropriate for implementation of long-range fixed microwave links, with an average distance of over 30 km.[15/] This allows shorter links, such as those likely to be found in urban areas, to have extra "fade margin," or signal protection, in order to ensure that the link stays on-line even under challenging circumstances.

In the case of the Manhattan-Queens link analyzed by CommScope, which is only 7.5 kilometers,[16/] the fade margin is over 46 dB,[17/] far greater than the default fade margin for a 6 GHz link, which is 37 dB.[18/] This means that, even using CommScope's overly conservative analysis, which results in 8.1 dB of interference above the threshold,[19/] the link remains within the standard fade margin for 6 GHz links without making any changes to its operating parameters. And, as detailed above, actual interference from LPIs is likely to be far lower than CommScope's analysis indicates.

15/ *See Comments of AT&T Services*, GN Docket No. 17-183 at 15 (filed Oct. 2, 2017).

16/ *CommScope Letter* at Attachment A, page 12.

17/ *See* Exhibit A, page 2.

18/ *See* National Telecommunications and Information Administration, INTERFERENCE PROTECTION CRITERIA, Phase 1 – Compilation from Existing Sources, NTIA Report 05-432 at Table 4-1 (FS DMS Default Values in Appendix 7 of ITU-R Radio Regulations).

19/ *CommScope Letter* at Attachment A, page 12.

Requiring AFC for LPIs Will Unnecessarily Impede Development of the 6 GHz Band for Unlicensed Use

Not only is coordination of LPIs unnecessary, but the imposition of that requirement will further delay Wi-Fi deployments in the band – critical to meet immediate and expanding needs for Wi-Fi connectivity. As noted previously, the 6 GHz Band is uniquely suited for Wi-Fi expansion because it is immediately adjacent to current unlicensed 5 GHz bands, allowing for rapid deployment of devices based on existing technologies. This is particularly true for LPIs that operate with regulatory constraints similar to 5 GHz. A new, additional coordination constraint on LPI in the 6 GHz band would negate many potential benefits in equipment costs, time-to-market, economies of scale and others, while offering little, if any, additional reduction in already negligible interference potential. In light of this and the growing spectrum shortage that will affect millions of Americans, Wi-Fi Alliance believes that its proposal offers a balanced regulatory approach.

Conclusion

Wi-Fi Alliance welcomes the work done by CommScope and its suggestions for collaborative effort on the 6 GHz Band sharing. Joint industry efforts have already significantly advanced the discussion on the 6 GHz Band and Wi-Fi Alliance supports further efforts to ensure the full protection of incumbent operations in this band. Wi-Fi Alliance therefore urges the Commission to quickly issue an NPRM proposing rules for RLAN operations in the 6 GHz band, and in particular for LPI and possibly other very low-power unlicensed operations.

* * * *

Pursuant to Section 1.1206(b)(2) of the Commission's rules, an electronic copy of this letter is being filed in the above-referenced docket. Please direct any questions regarding this filing to me.

Respectfully submitted,

/s/ Alex Roytblat

WI-FI ALLIANCE
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Attachment

EXHIBIT A

Link Parameters from ULS

- Victim receiver is WQCH635 (FDNY), Transmitter is WQCH829 (Liberty Plaza)
- http://wireless2.fcc.gov/UlsApp/UlsSearch/licensePathsDetail.jsp?pageNumToReturn=1&licKey=2923833&keyPath=272129
  - Rx Antenna Gain: 37.9 dBi
  - Rx Antenna Beamwidth: 1.9
  - Frequency: 6004.5 MHz
  - Transmit EIRP: 63.3 dBm
  - ATPC: No
  - Emission Designator: 30MOD7W, 172560 kbps, 128 TCM
  - Transmitter Manufacturer: HARRIS CORP. Model: HRS-CX-06G155M
- Distance between Tx & Rx is 7.45km, FSPL = 125 dB

Fade Margin Determination

- Rec. ITU-R F.1101, “Characteristics of digital fixed wireless systems below about 17 GHz” indicates that SNR required is 23.6 dB for 10^-6 BER for 128 TCM
- Assuming 5dB NF, Noise level is -94.2 dB
- C/N at receiver is 63.3 - 125 + 37.9 - (-94.2) = 70.4 dB
- Fade Margin is 70.4 - 23.6 = **46.8 dB**

- TIA TSB 10-F describes that IPC may be relaxed dB for dB when there is excess link margin.
- Default FS link margin for 6 GHz links is **37 dB** in ITU-R radio regulation (also cited by NTIA)
- *Hence, the IPC can be relaxed by 10 dB for this link*

RF Bandwidth Efficiencies

Capacity	Channel BW	Modulation	Efficiency
155 (OC-3, 3xDS3, 2xDS3+28xDS1) [1]	30 MHz	128 TCM w/FEC	5.75 b/s/Hz [2]
180 (4xDS3, 3xDS3+28xDS1)	30 MHz	256 TCM w/FEC	6.58 b/s/Hz [3]
28 x DS1, DS3	10 MHz	64 QAM w/FEC	4.8 b/s/Hz
16 x DS1	5 MHz	128 QAM w/FEC	5.6 b/s/Hz
8 x DS1	3.75 MHz	32 QAM w/FEC	3.8 b/s/Hz

[1] With 1 DS1 wayside channel
[2] 172.56 Mbit/s data rate into a 30 MHz RF channel
[3] 197.42 Mbit/s data rate into a 30 MHz RF channel

One Liberty Plaza, Manhattan, NY

- 54 story office building skyscraper, built in 1973. Its facade is black, consisting of a structural steel frame.
- EPA Energy Star Rating of 88 (likely thermally efficient)
- Distance: 7.4 km, Pathloss: 125 dB
- Analysis: Using Commscope assumptions, interference exceeds -6 I/N by 8.4 dB, however,
  - BEL should be 30 dB because this is energy efficient, which leads to higher loss; windows cannot be opened in building, APs are located in ceiling, with energy pointed directionally down. Single Entry interference would be less than -6 I/N
  - Has ~10 dB in excess fade margin, which can be used dB for dB to relax protection criteria. Single Entry would likely be 12 dB below level that would create harmful interference